eters, optical humidity sensors, such as laser-based sensors, or other sensors as would be apparent to one skilled in the art.

[0037] In certain embodiments, the gas flow provided over gas flow line **15** may be received from the ambient surroundings, e.g., the gas flow includes a natural airstream from the vicinity of the system. In some embodiments, the gas flow may be provided from a controlled gas source. For example, in the context of photosynthesis and transpiration measurements, gas sources could include reservoirs of CO_2 and H_2O, and conditioning equipment for controlling and conditioning each gas concentration in a gas flow line.

[0038] In some embodiments, the water buffering component may be configured to controllably adjust the amount of Nafion interacting with the gas flow, e.g., in response to a control signal received from a control system. For example, the water buffering component may be configured to adjust a number of Nafion beads, or a surface area of a Nafion membrane, interacting with the gas flow, e.g., by inserting additional beads or additional membrane into the gas flow, or removing beads or membrane material from the gas flow.

[0039] The effectiveness of using Nafion to buffer water vapor in an airstream has been demonstrated using an experimental arrangement including short lengths of tubing containing a number of spherical Nafion beads. The beads were installed in the flow-path between two non-dispersive infra-red (NDIR) gas analyzers. Changes to the in-coming water vapor content were dynamically controlled. FIGS. **2-4** demonstrate the effectiveness of Nafion in slowing the rate of incoming water vapor content.

[0040] The experimental arrangement consisted of a single conditioned air stream passing through a first water vapor analyzer, a water buffering element, and a second water vapor analyzer in series. The results in FIG. **2** illustrate the water concentration exiting the water buffering element, as measured by the second water vapor analyzer. The water vapor content of the conditioned air stream could be arbitrarily controlled. The function of the water vapor buffering element could be optimized by adjusting the number of Nafion beads (e.g., 3-4 mm in diameter) contained in the buffering element. The input water vapor concentration was decreased suddenly from approximately 10 mmol/mol to approximately 2 mmol/mol. The circular symbols (representing 0 beads) represents the water concentration exiting the water buffering element with no Nafion beads, and thus essentially follows the step change in the input concentration. FIG. **2** shows that increasing the number of Nafion beads (e.g., 24 beads, 38 beads and 64 beads) further slows the rate-of-change in the exiting air stream. Regardless of the number of beads added, the concentration eventually reaches in the input air stream concentration given sufficient time.

[0041] FIG. **3** illustrates incoming air water vapor concentrations as a function of time. The incoming air stream is not affected by the addition of Nafion beads, but there is some inherent minor variability in the method used to create the concentration variation.

[0042] FIG. **4** illustrates the water vapor concentration exiting the water buffering element when subjected to the inlet variations (as shown in FIG. **3**) for an increasing number of Nafion beads. The values are presented as the variation above/below the mean water concentration. For 0 beads, the exit air water concentration effectively follows the input values. As the number of beads in the water buffering element is increased, the water vapor rate-of-change is progressively slowed. Because the input water concentration is sinusoidally varying, slowing of the rate-of-change (which can be adjusted based on the number of beads) prevents the exit air stream from rising as high as, or falling as low as, the input stream.

[0043] The various embodiments herein are particularly useful for conducting stomatal conductance measurements. For example, the embodiments are useful for buffering an incoming and otherwise natural ambient airstream that has very rapid water vapor transients. The Nafion "buffer" is able to slow rapid transient fluctuations in real time so that a stomatal conductance measurement does not have artifacts/errors related to (what would otherwise be) rather large fluctuating water vapor transients entering the sample (leaf) chamber during the measurement. The duration of the measurement, along with the maximum rate-of-change in ambient humidity, are used to optimize the performance of the buffering function. The reference (incoming air) humidity measurement is also more stable, allowing the stomatal conductance measurement to be specified at a nominal humidity.

[0044] In certain embodiments, a control system (not shown), e.g., including one or more processors and associated memory, may be provided to control various system components, e.g., to control the flow of gas in system **10**. For example, the control system may control the flow rate or the amount or concentration of a gas and/or an analyte (e.g., water vapor concentration) in the gas provided. In an embodiment, the control system initiates real-time water vapor concentration measurements.

[0045] In certain embodiments, the control system or other intelligence module, which may include a processing component or components such as one or more processors and associated memory and/or storage, is configured to control, and to receive and process data from, the measurement devices to implement the methods disclosed herein, e.g., real-time concentration measurements of water vapor concentration and/or other analyte concentration or properties of interest.

[0046] Each processor or processing component is configured to implement functionality and/or process instructions for execution, for example, instructions stored in memory or instructions stored on storage devices, and may be implemented as an ASIC including an integrated instruction set. A memory, which may be a non-transient computer-readable storage medium, is configured to store information during operation. In some embodiments, a memory includes a temporary memory or area for information not to be maintained when the processing component is turned OFF. Examples of such temporary memory include volatile memories such as random access memories (RAM), dynamic random access memories (DRAM), and static random access memories (SRAM). The memory maintains program instructions for execution by the processing component.

[0047] Storage devices also include one or more non-transient computer-readable storage media. Storage devices are generally configured to store larger amounts of information than the memory. Storage devices may further be configured for long-term storage of information. In some examples, storage devices include non-volatile storage elements. Non-limiting examples of non-volatile storage elements include magnetic hard disks, optical discs, floppy